NASA Procedural Requirements

NPR 7120.5C
Effective Date: March 22, 2005
Expiration Date: March 22, 2010

COMPLIANCE IS MANDATORY

Printable Format (PDF)

Subject: NASA Program and Project Management Processes and Requirements

Responsible Office: Office of the Chief Engineer

APPENDIX K. Compliance Matrix

NOTE: For non-compliance, approved deviation(s) and/or waiver(s) must be attached

Program/Project Name:	Date:
Program/Project Manager:	
Requirement	Compliant (Yes/No)
2 CHAPTER 2. Program Management Requirements	
2.1 Four-Part Program Management Process	
2.1.a As a strategic management structure, the program construct is extremely important within NASA. Programs provide the critically important linkage between the Agency's ambitious goals and the projects that are the instruments for achieving them. Programs vary significantly in scope, complexity, cost, and criticality; however, a properly designed and executed program structure inevitably contributes to sound project management being embraced and practiced at lower levels. To initiate individual programs, a Mission Directorate (or Mission Support Office) shall prepare a program Formulation Authorization Document (FAD).	

2.1.b The Program Manager is responsible for ensuring that program goals address the Mission Directorate Strategies and Mission Support Office Functional Leadership Plans and that the program's content, which may contain multiple product lines, addresses those program goals. The Program Manager shall be responsible for recommending to the MDAA (or MSOD) the appropriate product line for each project in his/her program. The Program Manager coordinates program content with the Mission Directorate (or Mission Support Office), provides leadership, and is responsible for the successful accomplishment of the program that meets the needs of the customer. This chapter further delineates the management requirements for programs, described in terms of the four-part management process of paragraph 1.7.1. Program Managers shall meet all requirements outlined in this chapter irrespective of the size of the program.		
2.2 Program Formulation		
2.2.1 Purpose: The purpose of program formulation activities is to establish a cost-effective program that is demonstrably capable of meeting Agency and Mission Directorate (or Mission Support Office) goals and objectives. The program Formulation Authorization Document (FAD) authorizes a Program Manager to initiate the planning of a new program, and to perform the analyses required to formulate a sound Program Plan. A FAD template is found in Appendix A. The PCA is the agreement between the MDAA (or MSOD) and the NASA Deputy Administrator that authorizes transition from formulation to implementation. A PCA can be considered an executive summary of the Program Plan. A PCA template is found in Appendix B.		
2.2.2 Requirements: During program formulation, the Program Manager, once selected, shall:		
2.2.2.a Prepare a Program Plan.		
(1) In the Program Plan, the Program Manager shall define and document an affordable program architecture along with the success criteria and performance metrics. (A Program Plan template is provided in Appendix C.) Specifically, the Program Manager shall:		
(i) Ensure that top-level requirements, including success criteria, for each constituent project are defined in coordination with the Mission Directorate (or Mission Support Office) and documented in the Program Plan.		

(ii) Ensure the validated top-level requirements and program success criteria flow down to projects or portfolios. Program Managers are required to demonstrate this linkage (traceability) while formulating and implementing a program, and this linkage will be closely monitored when the Program Plan is reviewed.	
(iii) Prepare estimates of yearly New Obligational Authority (NOA) consistent with top-level program requirements, and identify the civil service workforce so as to enable full cost estimates.	
(iv) Prepare an overall program timeline with key milestones related to the accomplishment of program goals and objectives. When applicable, the timeline should provide guidance and a schedule for the announcement of new project (or research) opportunities.	
(v) Document synergistic activities with other NASA, industry, academia, and international programs.	
(vi) Prepare and implement a comprehensive Safety and Mission Assurance (SMA) Plan early in program formulation to ensure program compliance with all regulatory safety requirements from OSHA and all NASA Safety and Mission Assurance requirements such as mishap reporting and investigation, range safety, software safety and assurance, and human rating requirements. The importance of up-front safety, reliability, maintainability, and quality assurance requirements should be emphasized in all program activities.	
(2) Beginning early in program formulation, the Program Manager shall work with the Office of External Relations, the Deputy Chief Acquisition Officer, and the MDAA (or MSOD) to identify potential non-NASA partners and necessary agreements for international or interagency cooperation.	
(i) All activities and documentation shall be consistent with policy directives and with Mission Directorate (or Mission Support Office) and Agency-level agreements with the partners.	
(ii) All program-enabling commitments shall be obtained prior to program approval for implementation.	
(3) The Program Manager shall evaluate lessons learned from existing and previously executed programs and projects to identify applicable lessons for use in program planning and execution.	

(4) Early in program formulation, the Program Manager, in consultation with the MDAA (or MSOD), shall recommend a Technical Warrant Holder (TWH). The NASA Chief Engineer selects the TWH.	
2.2.2.b Create a program organizational and financial structure.	
(1) The Program Manager shall build a program organizational structure that assigns clear lines of responsibility, authority, and accountability to specific Centers, Project Managers, partners, advisory groups, and oversight boards.	
(2) Working in close cooperation with the OCFO, the Program Manager shall be responsible for creating financial management structures that comply with budget and accounting standards established by that Office.	
2.2.2.c Develop a program technical approach.	
(1) As applicable, the Program Manager shall identify scientific and engineering research and development strategies, develop constituent project (systems and operations) concepts, acquisition strategies, technology strategies, commercialization plans, agreements (e.g., space operations service agreements, launch services agreements, safety and mission assurance agreements) and logistics concepts, and incorporate them into the Program Plan. The most important aspect of this formulation activity is conducting a thorough analysis of alternatives (AoA), relying on architecture frameworks, program-level systems engineering, design reference mission analysis, and other formal techniques.	
(2) The Program Manager shall establish the program's methods for advanced technology insertion and validation, safety and mission assurance, environmental impact assessment, records and data management and distribution, physical and information security and program protection, and risk management, and incorporate them into the Program Plan.	
(3) The Program Manager shall incorporate the security considerations in NIST Special Publication 800-64, "Security Considerations in the Information System Development Life Cycle" in the lifecycle of all Information Technology related Programs.	
2.2.2.d Develop a continuous risk management process	

(1) The Program Manager shall develop and implement a continuous risk management process (that includes integrated risk management planning for all risks associated with program safety, cost, schedule, and technical performance), and document it in a program Risk Management Plan.	
(i) The Program Manager shall begin the process with risk identification and an assessment of program constraints, which defines the acceptable risks. Areas of potential program risks include, but are not limited to: mission success criteria; development schedule; budget limits; launch window and vehicle availability; international partner participation; critical single source suppliers; security; environmental concerns; human space flight safety issues; fail ops/fail safe requirements; safe and reliable operations; and the amount and type of testing.	
(ii) The Program Manager shall follow the NASA Continuous Risk Management (CRM) Process, shown as Figure 2-1 and Figure 3-2 in Chapter 3.	
(iii) The program Risk Management Plan shall describe periodic risk reviews, system safety, quantitative risk assessments, operations risk management, risk-based acquisition management, and information management systems for problem reporting, surveillance reporting, supportability data and trends analyses	
(2) All risks shall be documented and communicated throughout the program life cycle.	
(3) The results of the risk management process shall be incorporated into the final technical products.	
2.2.2.e Develop a closed-loop problem tracking process that includes problem or anomaly reporting, problem analysis, and corrective action.	
(1) The Program Manager shall develop a protocol to review past performance to determine the incidence of identical or related anomalies.	
(2) The Program Manager shall develop an escalation procedure (to inform higher levels of management) based on mission criticality.	
(3) The Program Manager shall develop a closeout process for root cause determination, anomaly mitigation, and recurrence control.	

(4) The Program Manager shall evaluate and disposition Government-Industry Data Exchange Program (GIDEP) Alerts, Safe-Alerts, Problem Advisories, Agency Action Notices and NASA Advisories, and shall exchange significant problem and nonconforming item data with other activities and with GIDEP.		
2.2.2.f Present the Program Plan for approval by the MDAA (or MSOD).		
(1) Prior to the program Non-Advocate Review (NAR), the Program Manager shall secure Program Plan concurrence by the cognizant MDAA (or MSOD) and from those Center Directors committing support to the program.		
(2) For single-project programs, the Program Manager shall either prepare both a Program Plan and a Project Plan, or integrate key elements of the Program Plan with all required elements of the Project Plan. The resultant Program Plan should fully meet the requirements described for both the program and project plans, including adequate linkage to the Agency Vision, goals, and objectives.		
(i) For the purposes of compliance with this document, formulation and implementation activities for single-project programs shall follow the requirements outlined for projects.		
(ii) A Formulation Authorization Document (FAD) and a Program Commitment Agreement (PCA) shall be required for a single-project program.		
2.2.2.g Support the Mission Directorate or the (Mission Support Office) in the preparation of a Program Commitment Agreement, based on the content of the Program Plan.		
2.3 Program Approval		
2.3.4 Requirements: In support of Agency PMC decision review meetings during program approval:		
2.3.4.a The Program Manager shall support evaluation by IPAO in accordance with the program evaluation process. (See paragraph 2.5.8 for more detailed requirements.)		
2.3.4.b The Program Manager shall prepare a program readiness overview briefing for presentation at the Agency PMC milestone decision review meeting that includes a summary of the program, the status of program documentation and products, concurrence of the TWH on technical requirements (including all variances), and significant risks, all appropriate to the level of program maturity.		

2.3.4.c The Program Manager shall prepare (and/or submit) the program documents and products described in Table 2-2. For programs that have a preliminary NAR, an updated FAD is not needed for the NAR.		
2.3.4.d At that meeting, the IPAO results and findings, including an Independent Cost Analysis (ICA), are also presented. The Program Manager shall then follow with a presentation of responses to the IPAO findings.		
2.4 Program Implementation		
2.4.2 Program Control		
2.4.2.2 Requirements: During implementation, the Program Manager shall:		
2.4.2.2.a Have a signed PCA before conducting activities associated with program or program element (project or portfolio) implementation.		
2.4.2.2.b Demonstrate a comprehensive program control function.		
(1) The program control function shall operate to ensure that cost, schedule, safety, and performance commitments made at the program and project levels are demonstrable in terms of agreed-upon metrics.		
(2) The Program Manager shall focus attention on assuring that projects are operating within the framework of the approved Program Plan.		
(3) The Program Manager shall monitor any program element reserves held at the program level and distribute them, as needed, to meet program goals and objectives.		
2.4.2.2.c Prepare and maintain detailed budgets, work authorizations, plans, and schedules.		
(1) The Program Manager shall provide a copy of the signed PCA to the OCE and OCFO.		
(2) The Program Manager shall support the Mission Directorate (or Mission Support Office) in updating the PCA through a revision when new content is added to the program (e.g., the creation of a new project); the revision shall be noted in the PCA change log.		

(3) The Program Manager shall evaluate the need for modifications of the Program Plan and the PCA due to changes in projects and activities within the program. Programs are usually long-lived constructs and should not require extensive modification during implementation. However, external funding changes or strategic shifts within the Agency can generate modifications to the PCA. Specifically, for ongoing programs:		
(i) The Program Manager shall support the Mission Directorate (or Mission Support Office) in updating the PCA through a modification when budget changes greater than 20 percent (20%) in a given year, or ten percent (10%) within a five-year horizon, occur.		
(ii) The Program Manager shall support the Mission Directorate or (Mission Support Office) in preparing the PCA modifications and documenting them in the PCA change log. The Mission Directorate will approve the modifications and take the modified PCA to the Agency PMC for an approval recommendation to the Deputy Administrator.		
(iii) The Program Manager shall support the Mission Directorate (or Mission Support Office) in preparing a briefing for the Agency PMC that describes factors driving the modification and shall support the briefing if requested. When the Deputy Administrator signs the modified PCA, the program modification is approved.		
(4) Budget data shall reflect, at all times, the full cost of implementing all aspects of the program. (For more information on full cost and practices, see Volume 7 of the NASA Financial Management Requirements.)		
(5) The Program Manager shall prepare and maintain a detailed schedule of program milestones and major planned events. Program Managers are encouraged to identify alternative development paths in order maximize the probability of success.		
(6) The Program Manager shall review and approve constituent Project Plans.		
2.4.2.2.d Oversee acquisition efforts.		
(1) The Program Manager shall ensure that all acquisition efforts and other transactions are implemented in accordance with Federal law and regulations (including the FAR or OMB Circulars, as applicable), and the NASA FAR Supplement, NASA directives, and the Program Plan.		

(2) The Program Manager shall ensure that standards and requirements flow down to external parties (i.e., contractors, grantees, and non-NASA parties to Space Act and other agreements and non-procurement instruments).		
2.4.2.2.e Conduct an integrated continuum of reviews. The Program Manager shall conduct the internal program reviews during implementation as specified in the Program Plan.		
2.4.2.2.f Disposition all risks before delivery to operations (or the equivalent for a technology program).		
2.4.2.2.g Support the Mission Directorate (or MSO) in preparing material for Quarterly Status Reviews (QSRs) to the Agency PMC.		
2.4.2.2.h Periodically evaluate the performance of Project Managers and their teams.		
2.4.3 Program Advocacy		
2.4.3.2 Requirements: During implementation, the Program Manager shall:		
2.4.3.2.a Advocate and promote customer involvement in the implementation of the program to assess progress against commitments.		
2.4.3.2.b Produce and execute a plan for education and public outreach by working with Mission Directorate education leads and the NASA Office of Education.		
2.4.4 Program Integration		
2.4.4.2 Requirements: During implementation, the Program Manager shall:		
2.4.4.2.a Maintain the continuity of requirements by ensuring that requirements are fully traceable from Agency vision and goals down through program requirements and top-level project requirements.		
2.4.4.2.b Ensure that the program is being implemented in a cost-effective manner by continuing to conduct architecture trades, technology assessments, mission analyses, and infrastructure and operational analyses that help structure program-level investments for maximum return.		
2.4.4.2.c Ensure that all investment areas (product lines) associated with the program are being managed in an integrated manner so that changes in one program investment area are reflected in all other related investment areas.		

2.4.4.2.d Ensure that all cross-cutting management elements of the program (e.g., safety, technology strategy, risk management) are being implemented in constituent projects in accordance with the Program Plan.		
2.4.4.2.e Identify and secure facilities, infrastructure, equipment (including GFE), materials, supporting personnel, and services that are required to support multiple projects within the program.		
(1) The Program Manager shall negotiate agreements with support providers, as needed.		
(2) For those products requiring transfer of custodial responsibility, the Program Manager shall ensure that acceptance/turnover activities, licensing, and documentation are addressed.		
(3) The Program Manager shall ensure that Project Plans account for the disposition of assets (orbital and other) after the end of their useful life		
(4) The Program Manager shall manage all salvageable assets (e.g., spares) remaining at the end of a constituent project's life cycle.		
2.5 Program Evaluation		
2.5.8 Requirements: To accomplish the on-going program evaluation process, the Program Manager shall:		
2.5.8.a Plan program team and schedule resources to support Independent Assessment (IA) for all required program decision reviews and Program Implementation Reviews (PIRs) (nominally every two years after the NAR approval). For initial planning purposes, the Program Manager should consult Table H-2 in Appendix H. The program's planning schedule may be modified through negotiation with the IPAO.		
2.5.8.b Comply with the evaluation Terms of Reference (ToR) for all independent reviews.		
(1) The ToR is prepared by the IPAO through negotiation with the MD (or MSO) point-of-contact. The ToR is approved by the OCE and the MDAA (or MSOD). The ToR specifies the details of conducting site field review events, including the schedule, deliverable items and areas of program risk. If the MD (or MSO) point-of-contact and the IPAO cannot agree on the ToR scope and content, the OCE shall be the final decision authority.		
(2) The final schedule shall be documented in the evaluation Terms of Reference (ToR).		

3.1.b This chapter delineates the common requirements for the management of projects, described in terms of the four-part management process of paragraph 1.7.1. The requirements of the chapter apply specifically to projects identified in Program Plans. It is recognized that these projects contain lower-level project activities managed by designated responsible organizations. The cognizant Mission Directorates, Mission Support Offices, programs, projects, or Centers shall flow down the requirements of this document. The Project Manager should also review all Mission Directorate, Mission Support Office, program, and Center-level documents that might include requirements beyond those in this document.		
3.1.c Managers of projects identified in a Program Plan shall meet all requirements outlined in this chapter irrespective of the size of the project and the program of which it is an element. Requests for deviations or waivers to NPR 7120.5C requirements shall be documented and submitted for approval to the Center Director, the Program Manager, Mission Directorate (or Mission Support Office), and the appropriate GPMC. The Project Manager should receive written authorization from the Office of Security and Program Protection for waiver of activities related to security. Prior to the NAR, these requests shall be documented in the NPR 7120.5C compliance matrix attached to a single deviation or waiver to assure proper routing and control. Deviations or waivers impacting formulation or requiring long lead-time shall be submitted individually early in formulation. Following the NAR, deviations or waivers shall be submitted individually to the approving authority described above. The compliance matrix, with approved deviations and waivers, shall be included as an appendix to the Project Plan.		
3.1.d Project IT investments shall be separately planned for, evaluated in terms of Return on Investment (ROI), budgeted, and managed. Refer to Chapter 7 for requirements related to IT investments made by all projects, regardless of type.		
3.2 Project Formulation		
3.2.1 Project Planning		
3.2.1.2 Requirements: The Project Manager and the project team shall:		
3.2.1.2.a Prepare the Project Plan.		

(1) At a minimum, the Project Plan shall contain all elements of the template provided in Appendix D. If the Project Manager chooses to write separate plans for some elements of the template, then the Project Plan shall summarize the salient points of the separate plans.	
(2) Sections of the Project Plan that are replaced by alternative approaches through an approved waiver or deviation shall be clearly identified in the Project Plan.	
(3) The Project Manager shall have the initial version of the Project Plan completed and ready for review by the Program Manager within the relevant milestone in the Appendix G.	
(4) The Project Manager shall secure approval of the Project Plan within the relevant milestone as identified in Appendix G. As a minimum, the cognizant Center Director and the Program Manager shall sign the Project Plan.	
(5) The Project Manager shall evaluate lessons learned from existing and previously executed projects to identify applicable lessons for use in project planning and execution.	
3.2.1.2.b Define a Work Breakdown Structure (WBS).	
(1) The WBS for the project shall encompass all the work required in the project, including both in-house and contractor efforts, over the project life cycle.	
(2) The WBS for the project shall be based on the appropriate product line template.	
(3) The WBS shall have a companion WBS dictionary that narratively describes the overall structure and content of each individual element of the WBS, and a WBS index linked to reference individual elements to the dictionary.	
3.2.1.2.c Prepare a project Integrated Master Schedule (IMS) as part of the Project Baseline.	
(1) The project IMS shall show all tasks necessary to accomplish the total scope of work derived from authorizing documents (e.g., FAD, PCA, Program Plan, Contract) and defined in the approved project WBS.	
(i) Activity durations shall identify the realistic number of work periods required to accomplish each activity in the IMS.	
(ii) Resource requirements, capacity, and availability shall be considered.	

(iii) Schedule reserve, based on risks and historical norms, shall be clearly identified.		
(2) The project IMS shall show all critical project milestones, logical relationships (interdependencies) for all tasks and milestones, and to include critical paths, when required based on both project category and product line type. (See product line chapters).		
(3) The project IMS shall have traceability to both lower-level detailed schedules and higher-level management summary schedules controlled by the approval authority (e.g., Program Manager, MDAA).		
3.2.1.2.d Create a team structure designed to assure mission success.		
(1) The Project Manager shall develop a team organization compatible with the WBS and the implementation strategies selected for the project. The project's organizational structure shall be documented in the Project Plan, Part 1, Project Management.		
(2) Project teams can be composed of civil service personnel, contractors, academia, partners, and customers. It is important that project teams have full and open communication. Clear lines of authority and communication must be demonstrated in the project organization chart. Therefore:		
(i) The Project Manager shall develop a project Communications Plan so as to foster effective (upward and downward) communication of critical management, technical, risk, and safety information.		
(ii) The Communications Plan shall specifically define the relationships among various project elements, and unambiguously identify responsibilities for problem reporting and subsequent decision making, during normal and contingency events.		
(iii) The Communications Plan shall define relationships and interactions with all stakeholders, team members, and supporting organizations.		
(iv) The Project Manager shall develop a plan to meet the program requirements for a closed loop problem tracking process, described in paragraph 2.2.2.e.		
(3) The balance of required skills, experience, and the size of the team will likely change through the project life cycle. Therefore, the Project Manager shall develop staffing plans consistent with the needs of the project over its life cycle, staff with personnel with the appropriate skills, abilities, and experience, and provide integrated team training to successfully execute the project.		

(4) The Project Manager shall negotiate required resources with applicable service pool managers.	
(5) In their supervisory capacity, Project Managers shall provide for the individual development of personnel that report directly to them. In addition, Project Managers should collaborate with line managers on the individual development needs of other members of the team. Project Managers should identify meritorious performance and create a strategy for using the NASA Awards and Recognition program to acknowledge successful, high-performing individuals and teams. Project Managers should take quick action to remedy unsatisfactory performance, whether through provision of additional guidance or training, or if necessary, changes in personnel.	
3.2.1.2.e Examine and manage requirements for advanced technology.	
(1) The Project Manager shall analyze technology requirements for feasibility, availability, technology readiness, and opportunities for leveraging ongoing research. Specifically,	
(i) The Project Manager shall evaluate sources of technology from other NASA Centers. One resource for accomplishing this is the NASA Technology Inventory Database at http://inventory.gsfc.nasa.gov.	
(ii) The Project Manager shall also identify commercial, academic, and other government agency sources of technology.	
(iii) Full cost assessments and risk assessments shall be performed to identify preferred sources of technology.	
(2) The Project Manager shall develop an integrated technology strategy to enable the project to meet its mission objectives. This strategy shall be documented in the Project Plan, Part 3, Technology Strategy:	
(i) The Technology Plan shall describe how the project will remove remaining technology gaps, including maturation, validation, and insertion plans, quantifiable milestones, decision gates, and resources required.	
(ii) Sources of technology shall be clearly identified in the Technology Plan.	
(iii) Distribution restrictions on the software, hardware, or data shall be clearly identified in the Technology Plan.	

(3) The Project Manager shall work with Center legal and commercialization personnel to establish how project-developed intellectual property (technologies, discoveries, innovations, tools, processes, or software) can be licensed or appropriately transferred to U.S. industry in other ways.		
(4) The Project Manager shall ensure that all planned technology exchanges, contracts, and partnership agreements comply with all laws and regulations regarding export control and the transfer of sensitive and proprietary information.		
3.2.1.2.f Analyze project infrastructure needs.		
(1) Working with the real property and industrial property offices, the Project Manager shall ensure that a comprehensive analysis of project infrastructure (real property/facilities, aircraft, personal property, and information technology IT) needs is performed. This analysis should include infrastructure required for: staff office space, test (including ground and flight facilities) and integration functions, research facilities, data systems, logistics and maintenance facilities, aircraft, and personal property and equipment.		
(2) The Project Manager, in coordination with the cognizant Center functional office, shall assess existing Agency-wide capabilities to meet infrastructure needs, and also assess whether facilities in other Government agencies, industry, academia, and international organizations can be utilized to reduce project LCC and risk. The Project Manager should work with the Program Manager, the MDAA, OCE, CIO, the Office of Infrastructure, Management, and Headquarters Operations, and other Headquarters offices to identify means of meeting infrastructure requirements through synergy with other programs and projects, thus avoiding costly duplication of supporting infrastructure.		
(3) A business case justification shall be performed for any proposed acquisition or major modification of infrastructure (e.g., facilities, IT).		
(i) The business case shall include full life cycle cost (including operations, sustainment, and disposal), benefit estimates, alternatives and sensitivity analyses, and risk assessments. (For more information on full cost and practices, see Volume 7 of the NASA Financial Management Requirements.)		

(ii) The business case shall be approved by the cognizant MDAA (or MSOD) who will coordinate with the NASA Headquarters functional office, or its designee(s).	
(4) First in coordination with the cognizant Center functional office, and then with the Headquarters Office of Infrastructure, Management, and Headquarters Operations, and/or the CIO, as appropriate, the Project Manager shall develop plans for any necessary upgrades or new developments, including those needed for environmental compliance (see paragraph 3.2.1.2j), and then document them in the Project Plan, Part 2, Resources.	
(5) The Project Manager shall comply with the provisions of NPD 7900.4 and NPR 7900.3, Aircraft Management Operations, before entering into agreements to procure or operate aircraft that might be necessary to the success of the project. The Project Manager shall directly coordinate with Center Chief of Flight Operations or the Headquarters Aircraft Management Office during the planning stage.	
(6) The Project Manager shall work with the respective offices at NASA Headquarters and Centers to assure that requisite spectrum allocations and airspace access are available, and if not, to obtain the necessary approval and permits.	
(7) The Project Manager shall comply with the provisions of current space transportation laws and policies, and NPD 8610.7, Launch Services Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads, and NPD 8610.12, Office of Space Operations (OSO) Space Transportation Services for NASA and NASA-Sponsored Payloads, involving launch assignment and acquisition before entering into agreements to procure launch services or launch vehicles. The Project Manager shall directly coordination with Space Operations Mission Directorate (SOMD) during planning and formulation for any project requiring launch.	
3.2.1.2.g Manage agreements.	

(1) Any use of interagency, industry, academic, and/or international cooperation agreements needs to be addressed early in project formulation. When these agreements are considered for a project, the Project Manager shall work with the appropriate Headquarters offices, and where necessary, have the agreements approved by them. All activities and documentation should be consistent with policy guidelines and with program, Mission Directorate (or Mission Support Office), and Agency-level agreements.	
(2) All agreements, memoranda of understanding, barters, in-kind contributions, and other arrangements for collaborative and/or cooperative relationships shall be identified in the Project Plan, Part 3, Cooperation and Commercialization, and the Project Manager shall maintain signed copies of all such agreements.	
3.2.1.2.h Complete an Acquisition Plan.	
(1) The Project Manager shall develop an integrated acquisition strategy that enables the project to meet its mission objectives, provides best value to NASA, and complies with the FAR and the NASA FAR Supplement. The Project Manager shall ensure that applicable laws, regulations, requirements, and standards are flowed down from NASA to the prime and sub-contractors. This strategy shall be documented in the Project Plan, Part 2, Acquisition Management.	
(i) The Acquisition Plan shall identify all major proposed acquisitions in relation to the project WBS.	
(ii) The Acquisition Plan shall consider the utilization of NASA in-house capabilities and the maintenance of NASA's core competencies when making make or buy decisions.	
(iii) The Acquisition Plan shall identify the project's approach to creating contractor incentives that strengthen safety and mission assurance.	
(iv) The Acquisition Plan shall identify significant ($1 million or more) equipment requirements expected to be acquired or fabricated by contractors in support of the project objectives.	
2) If systems contain software, the Project Manager shall ensure that software developed internally within NASA or acquired complies with NPR 7150.2, NASA Software Engineering Requirements, and NASA Standard 8739.8, Software Assurance Standard.	

(3) The Acquisition Plan shall establish a continuous Risk-Based Acquisition Management (RBAM) process:		
(i) The project acquisition planning team shall obtain input from Center personnel responsible for safety and mission assurance, health, environmental protection, information technology, export control, and security. The goal of this involvement is to ensure that the acquisition is structured to address appropriately the concerns of these disciplines as they relate to the requirement. (See NFS 1807.104.)		
(ii) During the solicitation process, any exchanges with industry prior to receipt of offers should include requests for any perceived safety, occupational health, security (including information technology), environmental, export control, and/or other programmatic risk issues associated with performance of the work. Similarly, when technical proposals are required as part of requests for proposals for supplies or services, offerors shall be instructed to identify and discuss risk factors and their approach for managing those risk factors (see NFS 1815.201 and NFS 1815.203-72). Where the solicitation requires submission of a Safety and Health Plan (see NFS 1823.7001(c)), safety and health shall be a consideration in the evaluation process (also see NFS 1815.305).		
(iii) Quality assurance surveillance plans shall be prepared with the statement of work for all performance-based contracts and, as necessary, for other contracts. The Project Manager shall follow NPR 8735.2, Management of Government Safety and Mission Assurance Surveillance Functions for NASA Contracts.		
(iv) Working with SMA, the Project Manager shall ensure that the plans reflect NASA's surveillance approach relative to the perceived programmatic risk. The plans are general at the outset, but after contract award, the Contracting Officer shall ensure that the plans are revised to reflect the risks associated with the successful proposal (see NFS 1846.401 and Procurement Information Circular 02-17).		
(4) The Acquisition Plan shall be reviewed and approved by the Program Manager prior to initiating any major procurement actions, as established in Section 3.2.4.		
3.2.1.2.i Complete a Safety and Mission Success Plan.		

(1) The Project Manager shall complete a Safety and Mission Success Plan and ensure close integration with the appropriate Safety and Mission Assurance (SMA) organization. The resulting plan can be incorporated into the Project Plan, Part 3, Safety and Mission Assurance.

(2) The Project Manager shall perform activities to provide for the early identification, analysis,reduction, and/or elimination of hazards that might cause the following:

(i) Loss of life or injury/illness to personnel;

(ii) Damage to or loss of equipment or property (including software);

(iii) Unexpected or collateral damage as a result of test;

(iv) Failure of mission;

(v) Loss of system availability; and/or

(vi) Damage to the environment.

(3) Project Managers shall establish safety and mission success activities as a part of the continuous risk management process early in the project formulation process. Specifically, the Project Manager shall:

(i) Incorporate health and safety principles in all planning.

(ii) Perform formal assessment and documentation of each hazard.

(iii) Control each hazard in accordance with the reduction protocol in NPR 8715.3, NASA Safety Manual.

(iv) Perform a safety assessment or readiness for flight or other operations, explicitly noting any exceptions arising from safety issues and concerns.

(v) Utilize a quality management system in compliance with NPD 1280.1, NASA Management Systems, and with appropriate supplier assessment and surveillance.

(vi) Provide a reliability, maintainability, and parts assurance program appropriate to the needs of the project.

(4) Each project that uses radioactive materials must have an internal NASA process in place for effective intra-Agency and interagency coordination in obtaining launch approval. Therefore:

(i) Each project shall ensure that system designs that use radioactive materials reduce public and worker exposure to radiation and radioactive materials to levels that are as low as reasonably achievable.		
(ii) Radiological contingency plans, commensurate with the potential health risk to the public, shall be developed for missions carrying radioactive materials in accordance with NPD 1820.1, NASA Environmental Health Program, and NPR 8715.3, NASA Safety Manual.		
(iii) Each project proposing to launch radioactive materials shall fully adhere to the NASA and Executive branch interagency coordination processes for nuclear launch safety approval in accordance with NPD 1820.1, NASA Environmental Health Program, and NPR 8715.3, NASA Safety Manual.		
(iv) The Project Manager shall support the NASA Headquarters Office of Safety and Mission Assurance (OSMA) and the Office of Security and Program Protection in obtaining nuclear launch safety approval.		
3.2.1.2.j Complete the Education and Public Outreach Plan. The Project Manager shall develop a plan that document linkages between science, engineering, technology, and mathematics (STEM), and the unique project content. Specifically, the plan shall incorporate elements that:		
(1) Demonstrate a compelling benefit to the public.		
(2) Show how each project demonstrates contributions to developing a pipeline promoting STEM careers and/or cultivating a workforce in science and technology.(3) Are designed to respond to a need identified by the education community, a customer, or a customer group (customer focus).(4) Demonstrate the connection to NASA missions and other activities that inspire and motivate the Nation's students and teachers, to educate the public, and to advance scientific and technological capabilities of the Nation.		
3.2.1.2.k Complete the Environmental Management Plan.		
(1) With the support of the cognizant Environmental Management Office (EMO), and in accordance with NPR 8580.1, Implementing the National Environmental Policy Act and Executive Order 12114, the Project Manager shall complete the Environmental Management Plan and incorporate it into the Project Plan, Part 3, Environmental Management.		

(i) The development of the Environmental Management Plan shall be integrated with the installation Environmental Management System so as to ensure appropriate approvals, permits, and consultations are made, and mission delay impacts are avoided or minimized.	
(ii) The Project Manager shall integrate public, intergovernmental, and interagency involvement with the Education and Public Outreach Plan.	
(2) Environmental planning needs to be integrated into project planning efforts early in formulation, as environmental protection compliance processes can be lengthy. These efforts are accomplished with the support of the cognizant EMO. Specifically:	
(i) The Project Manager shall support the Mission Directorate (or Mission Support Office) to ensure the completion of the NEPA process prior to taking any action which would either (1) have an adverse environmental impact; or (2) limit the choice of reasonable alternatives. In all cases, the Project Manager shall ensure the NEPA process, as explained in NPR 8580.1, Implementing the NEPA and Executive Order 12114, is completed prior to project implementation. The Project Manager should allow 6 to 18 months on average to complete the required NEPA documentation.	
(ii) The project schedule shall include specific milestones for the completion of other documentation required by nuclear launch safety, and other pertinent NASA regulations, environmental statutes and regulations, and Executive Orders.	
(iii) This documentation shall include an orbital debris assessment, if applicable.	
(iv) The Project Manager shall, with the EMO, ensure that all required permits, waivers, documents, approvals or concurrences are obtained to ensure compliance with all applicable Federal, State, Tribal government, and local environmental regulations.	
(3) The Project Manager shall comply with the applicable provisions of directives implementing NASA's planetary protection policy in NPD 8020.7, Biological Contamination Control for Outbound and inbound Planetary Spacecraft, and NPR 8020.12, Planetary Protection Provisions for Robotic Extraterrestrial Missions.	
3.2.1.2.l Ensure the security of personnel and physical resources under the control of the project.	

(1) The Project Manager shall work with the Chief of Center Security to identify and control threats to personnel, monitor the level of security-cleared personnel, and employ access control devices and other safeguards.	
(2) The Project Manager shall employ the recommendations of the Chiefs of Center Security that address physical security and loss-prevention measures within program and project facilities.	
(3) The Project Manager shall ensure that emergency response, mitigation, and recovery plans have been established for the project, in accordance with NPD 8710.1, Emergency Preparedness Program. These plans should be coordinated with the local Emergency Preparedness Office.	
(4) Each project shall complete preparations and ensure that response capabilities (to include restoration of program-unique resources and capabilities) are available when needed.	
(5) Each project shall ensure that contingency plans are in place to properly secure a mishap site, impound evidence, and provide necessary notification within the program and to designated Agency notification contacts.	
3.2.1.2.m Provide for information technology security.	
(1) The Project Manager shall take actions (appropriate to the level of sensitivity) to protect the integrity, availability, and confidentiality of project information systems, software applications, data, and information generated within their projects. This includes classified or sensitive information, export-controlled information, industry proprietary data, command, control and communications (C3) information and systems, websites, applications, and information and systems that support NASA's daily business activities (e.g., e-mail management reporting).	
(2) Project technical requirements shall include information technology security requirements, in accordance with NPR 1620.1, Security Procedures and Guidelines, NPR 2810.1, Security of Information Technology, and NASA Information Technology Requirements (NITR). Specifically, the Project Manager shall:	
(i) Conduct risk assessments, determine and implement risk-mitigating technologies or procedures, and manage residual accepted risks.	

(ii) Coordinate project security measures with established Center and Headquarters Boards governing NASA-wide infrastructure security measures.	
(iii) Address specific requirements for security of C3 systems and those systems containing or processing export controlled, proprietary, classified or other sensitive information.	
(iv) Address requirements for affording or limiting access by citizens of foreign countries involved in the project.	
3.2.1.2.n Provide for export control and foreign involvement.	
(1) The Project Manager shall comply with the requirements of NPR 2190.1, NASA Export Control Program.	
(2) All NASA international agreements contain a clause on transfers of controlled hardware, software technology, and data both from NASA to foreign partners and from foreign partners to NASA. The Project Manager shall comply with the clause when transfers are made from NASA to a partner or a contractor of a foreign country.	
(3) The Project Manager shall transfer only technical data, hardware, and software necessary to fulfill NASA responsibilities under international agreements. Specifically:	
(i) If foreign contracts are anticipated, the Project Manager shall assure that there is appropriate Headquarters review when required, and that such contracts are prepared with appropriate export control provisions.	
(ii) Applicable contracts with U.S. industry that support an international project shall also include appropriate provisions related to export control requirements.	
(4) Export control requirements and milestones shall be included in project plans.	
(5) When foreign nationals are involved, the Project Manager shall plan for internal technology transfer controls.	
(6) The Project Manager shall identify export license requirements and shall obtain any required export licenses prior to exporting.	

(7) As applicable, the Project Manager shall instruct contractors and partners of NASA obligations under international agreements, and of their responsibility for obtaining proper authority for any contractor and partner exports.		
(8) The Project Manager shall advise foreign partners of the sensitive nature of export controlled hardware, software, and data prior to transfer.		
3.2.2 Cost Estimation		
3.2.2.2 Requirements: The Project Manager and the project team shall:		
3.2.2.2.a Develop an initial Life Cycle Cost Estimate (LCCE).		
(1) The Project Manager shall develop an initial LCCE consistent with the project WBS, schedule, and performance parameters to form the project estimate (to be included in the initial Project Plan, Part 2, Resources.)		
(i) All cost and workforce estimates shall be summarized according to the NASA standard product line WBS and time phased by Government Fiscal Year (GFY).		
(ii) The project estimate shall always use the latest available full cost accounting initiative guidance and practices.		
(2) The project estimate shall include reserves, along with the level of confidence provided by the reserves.		
(3) Upon completion of the initial LCCE, the Project Manager shall provide it to the Program Manager.		
3.2.2.2.b Prior to the NAR, update the project estimate.		
(1) The Project Manager shall ensure that all elements of the project LCCE are internally consistent and have been updated in time for the NAR (at which time it is designated the NAR estimate).		
(2) In the event that the (Category I and II) project LCCE and ICE do not agree and cannot be reconciled, the OCFO Cost Analysis Division will provide a recommended cost position to the MDAA (or MSOD), Chief Financial Officer, and Chief Engineer, who together will make a recommendation to the Agency or Mission Directorate PMC. The Project Manager shall defer to their decision.		
3.2.3 Systems Engineering		
3.2.3.3 Requirements: The Project Manager and the project team shall:		

3.2.3.3.a Plan systems engineering tasks.	
(1) The Project Manager shall establish the project's overall systems engineering scope and approach, and document it in the Project Plan, Part 3, Systems Engineering.	
(i) The Systems Engineering Plan shall comply with an Agency-approved systems engineering standard.	
(ii) The Systems Engineering Plan shall describe how the standard's systems engineering processes will be instantiated by the project, including metrics, and shall identify any deviations and waivers from the standard.	
(2) The Project Manager shall identify and plan a series of cost-performance trade studies.	
(i) These trade studies shall, as a minimum, consider safety, performance, life cycle costs, project risks, technology alternatives, schedule, environmental concerns, operations and logistics, and infrastructure issues.	
(ii) In performing these trade studies, the Project Manager shall evaluate the advantages and risks of securing elements of the project from outside sources including partnerships and co-ventures with other government agencies, academia, industry, and foreign organizations.	
(3) The Project Manager shall plan software engineering tasks per NPR 7150.2, Software Engineering Requirements and NASA Standard 8739.8, Software Assurance Standard.	
3.2.3.3.b Define, validate, and manage project requirements. The Project Manager and project team shall flow down program requirements to define a validated set of high-level project requirements prior to entering implementation.	
3.2.3.3.c Perform system analyses. The Project Manager and project team shall complete planned cost-performance trades, such as Analysis of Alternatives (AoA) studies, Cost as An Independent Variable (CAIV) assessments, mission success probability assessment, and other systems analyses. (Reference L.2.a(8) provides useful detailed information on planning and conducting a formal AoA.)	

(1) Early in formulation, and in cooperation with the customer, the Project Manager shall define key performance parameters (KPPs) for the project that are selected on the basis of their close relationship with mission success criteria. These KPPs should appear in trade studies as measures of effectiveness and/or measures of performance.		
(2) As a result of these studies and analyses, but prior to the end of formulation, the Project Manager shall specify quantitative values (a goal value and a threshold value) for each KPP, which will then be incorporated into the Project Baseline (along with the related mission success criteria, schedule, and LCCE) and which will be used to evaluate project performance. For each KPP, the goal is the performance level that the project team is striving for, and the threshold is the minimum performance level that the MDAA (or MSOD) and Program Manager agree is acceptable for the system-of-interest or end item deliverable.		
(3) As a result of these studies and analyses, the Project Manager shall also establish a close link between each KPP and project technical performance requirements.		
(4) The Project Manager shall provide the final quantitative values of each KPP to the independent assessment (IA) organization as part of the NAR Baseline.		
3.2.3.3.d Define a preferred system design. The Project Manager and project team shall collect and allocate project requirements into an implementable architecture. This activity typically leads to a preliminary design of the system(s) to be developed.		
3.2.3.3.e Plan verification and validation efforts. The Project Manager and the project team shall complete the Verification and Validation (V&V) Plan and incorporate it into the Project Plan, Part 3, Test and Verification.		
(1) The V&V Plan shall clearly identify the approach to the verification of each requirement.		
(2) The V&V Plan shall include software/hardware integration and appropriate independent verification and validation of software.		
(3) The V&V Plan shall clearly identify the approach to system validation.		
3.2.4 Independent Technical Authority		
3.2.4.3 Requirements: During formulation:		

3.2.4.3.a Early in project formulation, the Project Manager, in consultation with the MDAA (or MSOD), shall recommend a Technical Warrant Holder. The NASA Chief Engineer selects the Technical Warrant Holder.	
3.2.4.3.b Once the high-level requirements have been defined by the Mission Directorate (or Mission Support Office), the Project Manager shall support the TWH in the establishment and maintenance of the subordinate technical requirements.	
(i) The Project Manager shall defer to the TWH in determining which standards and requirements affect safe and reliable operations involving human safety.	
(ii) The Project Manager shall only accept variances regarding technical standards and requirements affecting safe and reliable operations involving human safety when approved by the TWH. This does not preclude the Project Manager from requiring more extensive investigation.	
3.2.4.3.c The Project Manager shall communicate unresolved conflicts with the TWH to the Program Manager, and then to the appropriate MDAA (or MSOD) if required. Likewise, the TWH reports unresolved conflicts with the Program/Project Manager to the NASA Technical Authority (NASA Chief Engineer).	
3.2.5.2 Requirements: The Project Manager and the project team shall:	
3.2.5.2.a Begin to execute the Project Control Plan as early as practical in formulation.	
(1) The Project Manager shall review the EVM guidance provided in paragraph 3.4.3.2 to determine the appropriate application of EVM to the project.	
(2) The Project Manager shall develop a Project Control Plan, and incorporate it into the Project Plan, Part 3, Project Control.	
(3) The Project Manager shall ensure that all elements of the Project Control Plan are fully operational prior to the NAR.	
3.2.5.2.b Establish and conduct a continuum of technical and management reviews.	
(1) Reviews provide a venue for communication, coordination, and integration of project activities. The Project Manager shall develop a Project Review Plan, and incorporate it into the Project Plan, Part 3, Reviews.	

(2) The Project Manager shall conduct the formulation phase internal reviews, as specified in the Project Review Plan, to ascertain the status of the project, and to provide an integrated, independent technical assessment of the project's technical risk, and its readiness to proceed to the next level of maturation.	
(3) At each such review, the Project Manager shall synthesize and document engineering and management inputs, issues, and recommendations (e.g., Review Item Discrepancies, Requests for Actions).	
(i) All such review inputs shall be subsequently analyzed, and recommendations/action items tracked and dispositioned.	
(ii) An index of review inputs and recommendations shall be maintained, and made available at all subsequent reviews.	
3.2.5.2.c Establish and implement configuration management. The Project Manager shall develop a Configuration Management Plan, and incorporate it into the Project Plan, Part 3, Configuration Management.	
3.2.5.2.d Put in place a comprehensive risk management decision making process.	
(1) In accordance with NPR 8000.4, Risk Management Procedures and Guidelines, the Project Manager shall establish a continuous risk management (CRM) process that identifies risks; analyzes their impact and prioritizes them; develops and carries out plans for risk mitigation or acceptance; tracks risks and the implementation of mitigation plans; supports informed, timely, and effective decisions to control risks and mitigation plans; and assures that risk information is communicated and documented. (The CRM process is shown in Figure 2-1.)	
(2) The Project Manager and project team shall develop a Risk Management Plan that meets the program requirements for CRM processes as described in paragraph 2.2.2.d, and incorporate it into the Project Plan, Part 3, Risk Management.	
(3) Risk identification shall involve the entire project team to assess all identifiable risks and project constraints up front. If an Independent Assessment (IA) has been performed, the project shall include the risks identified during the assessment as input.	

(4) Each project shall follow the CRM process steps as shown in Figure 3-2; this process is iterated throughout the project life cycle. Specifically, the Project Manager and the project team shall:		
(i) Identify. Develop the risk statements in terms of condition and consequence(s); capture the context of the risk scenario; e.g., what, when, where, how, and why. Tools such as Failure Modes and Effect Analyses (FMEA), Probabilistic Risk Assessment (PRA), and Fault Tree Analyses (FTA) can be used to identify risks. During engineering product development, risk will be identified and addressed in the final product as part of a risk management plan, in accordance with systems safety engineering practices.		
(ii) Analyze. Evaluate risk probability, impact/severity, and timeframe (when action needs to be taken); classify/group with similar/related risks; and prioritize. Tools such as Probabilistic Risk Assessment (PRA) can be used to analyze risk.		
(iii) Plan. Assign responsibility, determine approach (accept, mitigate, or watch); if risk will be mitigated, define mitigation level (e.g., action item list or more detailed task plan) and goal and include budget estimates.		
(iv) Track. Acquire/update, compile, analyze, and organize risk data; report results; and verify and validate mitigation actions.		
(v) Control. Analyze results, decide how to proceed (replan, close the risk, invoke contingency plans, continue tracking); execute the control decisions.		
(vi) Communicate and document. Essential risk status is to be communicated on a regular basis to the entire project team, as well as to the GPMC. A system for documentation and tracking of risk decisions will be implemented.		
(5) The Project Manager shall use the risk management process as a basis for decisions to mitigate cost, schedule, technical, environmental, security, or safety risk. Examples include, but are not limited to mission success criteria; development schedule; budget limits; launch window and vehicle availability; international partner participation; critical single-source suppliers; security or environmental concerns; human space flight safety issues; "fail ops/fail safe" requirements; facilities and infrastructure limitations; technology readiness; surveillance requirements; and amount and type of testing.		

(6) For each primary risk, the project shall develop and maintain the following in accordance with the Risk Management Plan, and as appropriate, in the PCA.		
(i) Description of the risk, including primary causes and contributors, actions embedded in the program/project to date to reduce or control it, and information collected for tracking purposes.		
(ii) Identify primary consequences (including effects on safety, project cost, schedule, and performance), should the undesired event occur.		
(iii) Estimate of the probability (qualitative or quantitative) of occurrence together with the uncertainty of the estimate. The probability of occurrence should take into account the effectiveness of any implemented risk mitigation measures.		
(iv) Characterization of the risk as "acceptable" or "unacceptable" with supporting rationale.		
(7) Characterization of a primary risk as "acceptable" shall be supported by the rationale, with the concurrence of the GPMC, that all reasonable mitigation options (within cost, schedule, and technical constraints) have been instituted. Moreover, the GPMC must concur that, given the risks and their impact on the probability of the project meeting its requirements, the expected value of the project is still sufficient to justify the costs of undertaking it.		
3.2.5.2.e Identify project standards and practices.		
(1) The Project Manager shall document the technical standards and any intended variances from NASA Preferred Standards as identified by the TWH in the Project Plan, Part 3, Standards and Practices.		
(2) The Project Manager shall acquire approvals from the Technical Warrant Holder, and other authorities as appropriate, before executing any variances from mandatory NASA standards or specifications as established in Section 3.2.4.		
(3) In accordance with the Standards and Practices section of the Project Plan, the Project Manager shall ensure that designs utilize the International System of Units (SI, metric measurement system), in concurrence with NPD 8010.2, Use of the SI (Metric) System of Measurement in NASA Programs.		
3.3 Project Approval		
3.3.3 Requirements: In support of GPMC decision review meetings during project approval:		

3.3.3.a The Project Manager shall support evaluation by the IA organization in accordance with the project evaluation process. (See Section 3.5.)		
3.3.3.b The Project Manager shall prepare a project readiness overview briefing for presentation at the GPMC milestone decision review meeting to include a summary of the project, the status of project documentation and products, concurrence of TWH on technical requirements (including all variances), and significant risks, all appropriate to the level of project maturity.		
3.3.3.c The Project Manager shall prepare (and/or submit) the project documents and products described in Table 3-1.		
3.3.3.d At that meeting, the IA results and findings, including an ICE for Category I and II projects, will also be presented. The Project Manager shall then follow with a presentation of responses to the IA findings.		
3.4 Project Implementation		
3.4.3.2 Requirements: The Project Manager and the project team shall:		
3.4.3.2.a Execute the Project Control Plan. The intent of this requirement is to maintain close configuration control of requirements, to assess the cost, technical and schedule status of the project relative to the NAR Baseline. Therefore:		
(1) EVM principles as defined by EIA-748-A shall be applied to all projects (contractor and civil service) exceeding $20M total project cost. However, the MDAA (or MSOD) can require EVM principles be applied to any project or activity.		
(2) A fully validated EVM system as defined by EIA-748-A shall be applied to all projects (contractor and civil service) exceeding $50M total project cost. However, the MDAA (or MSOD) can require a fully validated EVM system be applied to any project or activity.		
(3) In implementing (1) and (2) above, the Project Manager shall ensure (for all applicable procurements) the appropriate provisions and clauses are included in solicitations and contracts.		
(4) For projects requiring EVM, the Project Manager shall conduct and complete Integrated Baseline Reviews (IBRs) on projects to ensure the validity of the baseline.		

(i) The IBR shall be accomplished within six months after contract award or after approval of the Project Plan by the MDAA (or MSOD).		
(ii) The IBR shall be accomplished within two months after definitization of significant scope changes or after budget realignment.		
(5) Surveillance of contractor EVM systems is normally delegated to the Defense Contract Management Agency (DCMA) in accordance with the NASA/DCMA Memorandum of Understanding (MOU) for Earned Value Management System Acceptance/Surveillance and Earned Value Management Project Surveillance. When such surveillance is to be delegated, the Project Manager shall, in coordination with the Contracting Officer, initiate the action for the Contracting Officer to issue a letter of delegation to the responsible DCMA activity. The letter of delegation shall define the specific support, products, services, etc. to be provided by the DCMA. (See FAR Part 42.2.)		
(6) Expenditures shall be accumulated according to the WBS established for the project, and in as near-real time as possible. Consistent with Continuous Cost-Risk Management (see reference L.2.a(1)), in addition to standard WBS-level performance measurement reporting, performance measurement of medium- and high-risk WBS elements identified during life cycle cost estimation shall be provided to the Project Manager through specification in the Cost Performance Report (CPR) Data Requirements Description (DRD) and/or the Project Plan.		
(7) The full cost of civil service labor shall also be accumulated according to the WBS to permit later integration into full cost accounting and reporting.		
(8) Use of EVM is optional in contracts with research institutes and in grants of any type. In such cases, when EVM is appropriate to the project but not to such project components, the Project Manager shall include in the Project Plan, Part 3, Control, the strategy for integrating cost and schedule aspects of those project components.		
3.4.3.2.b Manage reserves.		
(1) Project Managers have the authority to make decisions, allocate reserves, and modify the implementation path in response to new information. The Project Manager shall closely monitor the application of project reserves.		

(2) The Project Manager shall treat all program transfers to the project during implementation, other than planned project reserve funds being held by the Program Manager, as augmentations to the Project Baseline. This includes the use of civil service labor above the staffing plan provided by the project. Such transfers may not imply an impending breach, but the Project Manager must follow paragraph 3.4.3.2e.		
3.4.3.2.c Perform continuous risk management.		
(1) The Project Manager and project team shall perform the five-step continuous risk management process of Figure 3-2 during implementation.		
(2) The Project Manager shall ensure that all elements of the Risk Management Plan are followed.		
(3) The Project Manager shall communicate risk mitigation actions taken, the effectiveness of risk mitigation activities, and residual risks to the Program Manager for QSR briefings.		
(4) All risks shall be dispositioned before the transition to operations or the equivalent for an advanced technology project.		
3.4.3.2.d Conduct the implementation phase reviews specified in the Project Review Plan.		
(1) The Project Manager shall conduct the implementation phase internal reviews, as specified in the Project Review Plan, to ascertain the status of the project, and to provide an integrated, independent technical assessment of the project's technical risk, and its readiness to proceed to the next level of maturation.		
(2) For each review, the Project Manager shall synthesize and document engineering and management inputs, issues, and recommendations (e.g., Review Item Discrepancies, Requests for Actions).		
(i) All such review inputs shall be subsequently analyzed, and recommendations/action items tracked and dispositioned.		
(ii) An index of review inputs and recommendations/action items shall be maintained, and made available at all subsequent reviews.		
3.4.3.2.e Provide information and data regarding a breach of the NAR Baseline.		
(1) The Project Manager shall monitor project performance and provide trending data to the Program Manager.		

(i) For the cost metric, cost growth shall be measured after project approval using the latest project cost Estimate at Completion (EAC) against the NAR cost baseline (the approved NAR estimate). (Since the NAR estimate contains project reserves, cost growth occurs only when these reserves are exhausted.)		
(ii) For the schedule metric, schedule growth shall be measured after project approval using the latest project schedule Estimate at Completion (EAC) against the NAR schedule baseline. The schedule baseline shall start from the date of project FAD approval and shall extend through project completion (considered to be end of prime mission for long-lived projects).		
(iii) KPP changes shall be measured using the latest project performance against the NAR threshold values.		
(2) The Project Manager shall report to the Program Manager when the results of surveillance reviews conducted by IA organizations indicate that a breach is to be expected.		
(3) When projected cost or schedule performance exceeds the NAR Baseline by ten percent (10%), or a KPP breaches its threshold value, the Project Manager shall report the breach to the Program Manager and the information shall be presented to the GPMC.		
(4) The Project Manager shall coordinate with the Program Manager to provide a proposed continuation or termination plan to the GPMC.		
3.4.3.2.f Evaluate and coordinate actions related to changes in project scope, requirements, schedules, funding, or anticipated progress. Changes to the Project Baseline that lead to commensurate changes in the procurement requirements and deliveries shall be quickly communicated in the form of procurement change documentation.		
3.4.3.2.g Maintain configuration management.		
(1) The Project Manager shall ensure that baselined project documents are maintained under configuration management.		
(i) The Project Manager shall maintain configuration management on all drawings, design specifications, part selections, and other means of documenting aspects of the design (e.g., close-out photographs).		
(ii) Final versions of design documentation shall reflect the "as-built," "as-delivered," or "as-deployed" configuration of the system/asset.		

(2) The Project Manager shall place all dimensions of the Project Baseline (cost, schedule, and KPPs) under configuration management, retaining the Project Baseline at the time of the NAR (the NAR Baseline) as the datum against which changes are measured.		
3.4.3.2.h Maintain project team awareness of emergency response plans and procedures. Specifically, the Project Manager shall test those procedures at planned intervals during project implementation.		
3.4.3.2.i Protect intellectual property and technology. The Project Manager shall protect contractor proprietary data provided in support of Government analyses and reviews, and maintain required non-disclosure agreements (NDAs).		
3.4.4 Customer Advocacy		
3.4.4.2 Requirements: The Project Manager and the project team shall:		
3.4.4.2.a Maintain close customer interactions per the Project Plan. Specifically, the Project Manager shall proactively consult and involve customers in implementation activities, especially efforts that impact requirements and KPPs.		
3.4.4.2.b Involve customers as an integral part of evaluating progress against commitments.		
3.4.5 Systems Engineering		
3.4.5.2 Requirements: The Project Manager and project team shall:		
3.4.5.2.a Define, validate, and manage project requirements.		
(1) Throughout implementation, the Project Manager shall maintain a well-documented hierarchy of validated project requirements.		
(2) The Project Manager shall ensure that the hierarchy of requirements and the resulting end-item specifications, including those for software, GFE, and operations, are maintained under configuration management, and that modifications to requirements are recorded in a change log as part of overall project configuration management mechanisms.		
(3) The Project Manager shall evaluate changes in requirements that impact safety, quality, cost, schedule, and performance, and incorporate the impacts as changes to the Project Baseline.		

3.4.5.2.b Manage technical resource margins (e.g., mass, volume, power). The Project Manager shall manage all technical resource margins and apply project-level technical reserves as needed during design maturation.		
3.4.5.2.c Implement the closed loop problem tracking process developed during formulation. (See paragraph 3.2.1.2.d(2)(iv).)		
3.4.5.2.d Comply with the Standards and Practices section of the Project Plan.		
(1) The Project Manager shall ensure that standards and practices identified in the Project Plan are implemented.		
(2) The Project Manager shall acquire approvals from the Technical Warrant Holder, and other authorities as appropriate, before executing any variances from mandatory NASA standards or specifications as established in Section 3.2.4.		
3.4.5.2.e Complete verification and validation (V&V) activities.		
(1) The Project Manager shall implement the V&V strategy outlined in the V&V Plan. The Project Manager and project team should be ready to adjust the plan during implementation to deal with unexpected events and the need for additional verification.		
(2) The Project Manager shall be responsible for assuring that proper inspection, testing, screening, and/or other verifications have been performed.		
(i) Test plans shall include acceptance criteria.		
(ii) Test data shall be fully documented and maintained to support downstream analyses of project products and services, and of any operational anomalies and mishaps, if needed.		
(3) Deliverable products/services shall be verified prior to transfer for operations.		
3.4.6 Design, Develop, Transition-To-Use, and Operations		
3.4.6.2 Requirements: The Project Manager and the project team shall:		
3.4.6.2.a Implement the technology strategy.		

(1) The Project Manager shall closely monitor the readiness of advanced technology developments occurring within the project or being supplied under partnering agreements, as per the technology strategy, for the purpose of exercising alternative technology options before the project's cost and schedule are at risk. Technologies supplied by outside sources should be tracked as high risk deliveries until such time that objective data can confirm that lower risk levels are appropriate.		
(2) The Project Manager shall ensure that adequate resources are made available to document the design, development, certification, and validation of technologies created under project auspices.		
(3) The Project Manager shall periodically update the appropriate Center and Headquarters commercialization offices with information relevant to the commercialization of project-developed intellectual property (i.e., technologies, discoveries, innovations, tools, processes, or software) by U.S. industry.		
3.4.6.2.b Generate a procurement package for each acquisition action.		
(1) The Project Manager shall generate a procurement package that contains a statement of work including performance standards, specifications, documentation deliverables, and other applicable data.		
(2) In this process, the Project Manager shall use a Draft Request for Proposals (DRFP) as required by NFS 1815.201, Exchanges with Industry Before Receipt of Proposals, to ensure that comments on acquisition requirements (from contractors and other potential providers) are obtained. When a DRFP is not required, the Project Manager should consider a less formal method for obtaining industry comment.		
3.4.6.2.c Develop and execute contracts and non-procurement instruments.		
(1) In collaboration with the appropriate Center and/or Headquarters offices, the Project Manager shall develop or select the most appropriate acquisition instrument, per the Acquisition Plan, to satisfy program and project goals.		

(2) The Project Manager shall assist the Contracting Officer in the solicitation and award of contracts, and in the development of a plan to ensure appropriate surveillance, monitoring, and reporting of activities related to contracts and non-procurement instruments in accordance with Federal law and regulations.		
(3) If systems being acquired contain software, the Project Manager shall ensure compliance with the software contract requirements in NPR 7150.2, NASA Software Engineering Requirements.		
3.4.6.2.d Closely monitor contractor performance.		
(1) The Project Manager shall ensure that adequate contract mechanisms are in place to ensure timely and complete receipt of contractor (or grantee) financial and progress reports throughout the contract life cycle.		
(2) With the aid of the Contracting Officer (or other cognizant acquisition specialist), the Project Manager shall continually assess the performance of each contractor (or grantee). The Project Manager has a responsibility to ensure that the value of items or services received remains commensurate with the plan for funds expended.		
(i) EVM shall be used as a tool to monitor contractor performance as described in paragraph 3.4.3.2.		
(ii) Records of contractor and grantee performance shall be maintained in accordance with Government, Agency, Mission Directorate, and Center policies to support future source selection activities.		
(iii) The Project Manager and the Contracting Officer shall report the Government's assessment of performance to the contractor (or grantee).		
(3) In cases where the Defense Contract Management Agency (DCMA) conducts or supports the performance monitoring function, the Project Manager shall ensure that DCMA responds to requests for information in a timely fashion.		
(4) The Project Manager and the Contracting Officer shall perform surveillance of contractor safety and mission assurance performance in accordance with NPR 8735.2, Management of Government Safety and Mission Assurance Surveillance Functions for NASA Contracts.		

3.4.6.2.e Ensure that safety and reliability are an integral part of the product/service design, development, production, and operations. Specifically, where the safety of the public, NASA or contractor personnel is at risk, the Project Manager shall reinforce NASA's first core value, Safety, and emphasize to the project team that safety of the public, NASA flight crews, government and contractor employees, and Agency critical assets is of paramount importance.		
3.4.6.2.f Ensure compliance with property control rules and regulations.		
(1) The Project Manager shall ensure that property control rules and regulations are carefully followed. Specifically, the Project Manager shall ensure that:		
(i) Property is safeguarded at all times.		
(ii) Equipment, systems, components, and other elements of hardware and software developed under contract(s) and/or grant(s) are not transported without required documentation being executed.		
(iii) Parts, equipments, and components under NASA control are stored in secure facilities with environmental controls and location tracking appropriate to the value of the property.		
(2) The Project Manager shall also ensure that NASA personnel follow property control rules and regulations when accessing parts and equipment under property control by contractors.		
(3) The Project Manager shall ensure that NASA personnel follow Agency guidance in procuring spare parts per NPR 5900.1, NASA Spare Parts Acquisition.		
3.4.6.2.g Execute Quality Assurance Plans.		
(1) The Project Manager shall ensure that government, contractor, and grantee personnel follow design, development, manufacturing, and fabrication quality assurance practices matched to the investment that the project represents.		
(2) The Project Manager shall ensure the completeness and integrity of Quality Assurance Plans or other documentation developed to measure the quality of products and services delivered by the project.		
3.4.6.2.h Transition the system/asset to the end-user for operations.		

(1) The Project Manager shall establish and maintain an integrated logistics support capability to enable continued operations consistent with the system/asset's intended use.		
(2) The Project Manager shall ensure that adequate checkout of the system/asset is performed, and that formal acceptance of the delivered item(s) is secured at the appropriate transition point.		
3.4.6.2.i As part of sustaining engineering, perform trend analyses.		
(1) The Project Manager, with the TWH, shall monitor system incidents, problems, and anomalies, as well as system margins to ensure that deployed project systems function as intended.		
(2) Adverse trends shall be carefully evaluated and alerts shall be issued to the Program Manager, if adverse trends cannot be reversed.		
(3) The Project Manager shall ensure that project engineering data related to failures, anomalies, evaluations, problems, incidents, and Requests for Action (RFAs) are captured, retained, and made available to the NESC upon request.		
3.4.6.2.j Ensure the orderly disposition of the system/asset at the end of its useful life.		
(1) The Project Manager shall ensure that all requirements are met for archiving, preserving, transferring, and/or disposing of data, information, hardware, and software components.		
(2) Records shall be maintained that track disposed assets.		
(3) For assets with retained value, an asset valuation shall be performed prior to final disposition.		
3.4.7.2 Requirements: During implementation, the Project Manager and the project team shall:		
3.4.7.2.a Include the Technical Warrant Holders (TWHs) as a part of the Project Manager's analysis, evaluation, and technical decision-making processes.		
3.4.7.2.b Ensure that variances from technical standards and requirements affecting safe and reliable operations have been approved by the TWH and other authorities as appropriate.		
3.4.7.2.c Communicate unresolved conflicts with the TWH to the appropriate MDAA (or MSOD). Likewise, the TWH reports unresolved conflicts with the Program/Project Manager to the NASA Technical Authority (NASA Chief Engineer).		

3.4.7.2.d Obtain the technical approval of the cognizant TWH for the guiding technical requirements governing the conduct of risk assessments and analysis.	
3.4.8 Capture Knowledge	
3.4.8.2 Requirements: The Project Manager and the project team shall:	
3.4.8.2.a Ensure that project engineering and cost data, technical management information, and official project records (collectively called the project library) are captured electronically, retained, secured, disseminated, and managed in accordance with agreements, the Project Plan, and program, Center, and Agency policies.	
3.4.8.2.b Provide the OCE with inputs to the Lessons Learned Information System in the form of captured experiences and lessons learned by the project team throughout the project lifecycle, for example, at major milestones.	
3.5 Project Evaluation	
3.5.8 Requirements: To accomplish the project evaluation process, the Project Manager shall:	
3.5.8.a Plan project team and schedule resources to support IA for the NAR decision review. For initial planning purposes, the Project Manager should consult Table H-3 in Appendix H. The project's planning schedule may be modified through negotiation with the IA organization.	
3.5.8.b Comply with the evaluation Terms of Reference (ToR) or equivalent for all independent reviews.	
(1) The ToR or equivalent is prepared by the IA organization through negotiation with the Project Manager and Program Manager, MD (or MSO) point-of-contact, or appropriate organization. The ToR is approved by the OCE and the MDAA (or MSOD). The ToR (or equivalent) specifies the details of conducting site field review events, including the schedule, deliverable items and areas of project risk. For IAs performed by IPAO or SMO, if the negotiating parties cannot agree on the ToR scope and content, the OCE shall be the final decision authority.	
(2) The final schedule shall be documented in the evaluation Terms of Reference (ToR).	

(i) Define and document portfolio objectives that support Agency, Theme, and program goals. The Portfolio Manager coordinates with the cognizant MDAA (or MSOD) and Program Manager.	
(ii) Define a process for the solicitation, evaluation, and selection of proposals (including identifying Selection Official(s)).	
(iii) Establish evaluation criteria including considerations of quality, relevance to NASA missions and strategic goals, and performance.	
(iv) Include an integrated portfolio budget typically for three or five years (including appropriate WBS elements).	
(v) Include a multi-year schedule for the portfolio.	
(vi) Include portfolio evaluation processes.	
(2) Create a management and control structure to implement the Portfolio Process Plan.	
4.2.1.b Obtain approval of the Portfolio Process Plan. The Portfolio Manager shall forward the Portfolio Process Plan to the Program Manager for approval.	
4.2.2 Proposal Solicitation, Evaluation, and Selection Requirements: The Portfolio Manager shall:	
4.2.2.a Initiate solicitation and receipt of proposals through the issuance of a Broad Agency Announcement following the process established in the approved Portfolio Process Plan. Prospective PIs participate in portfolio formulation by preparing and submitting proposals in response to a solicitation. Research proposals for individual investigations include proposed research designs, budgets, schedules, and expected outcomes.	
4.2.2.b Using peer review processes established in NPR 1080.1, Science Management, evaluate proposals based on the criteria established in the solicitation.	
4.2.2.c Recommend proposals for selection. Specifically, the Portfolio Manager shall:	
(1) Review findings from peer review and other factors, and recommend selections for approval by the Selection Official.	
(2) Include the rationale for selection or non-selection of each proposal evaluated.	
(3) Include a description of all research activities within the portfolio including activities that are continued from previous years.	
4.3 Portfolio Approval	

5.2.2.a Perform technology portfolio analyses. The Project Manager shall ensure that portfolio analysis studies are conducted to justify technology selections. Techniques such as Alignment Matrices, ROI vs. Risk Matrices, Technology S-curve Maps, etc. can be used to determine the best mix of technologies that will balance the project's risk posture.		
5.2.2.b Identify a set of project KPPs (a goal value and a threshold value for each).		
(1) These KPPs shall be defined as the performance parameters associated with the end item delivery of the technology to the application community. The KPPs must consist of measurable engineering parameters that would be readily understood and used by engineers concerned with the ultimate application of the technology. For each KPP, the goal is the performance level that the project team is striving for, and the threshold is the minimum performance level that users agree is acceptable for the end item deliverable. Typically the threshold KPPs values are set beyond the current state-of-the art to warrant investment in the project.		
(2) When the ATD project contains multiple tasks and end items deliverables, KPPs shall be identified for each task or end item deliverable.		
5.2.2.c Complete the project estimate.		
(1) With the cognizant Program Manager, the Project Manager shall establish a project cost estimate based on the delivery of technology end items with the agreed-upon KPPs at the required end TRL.		
(2) The basis of cost and schedule estimates, including defined reserves, shall be defined in relation to the goal and threshold KPP values.		
5.2.2.d Prepare a Project Plan containing the elements described in Appendix D, with the following modifications:		
(1) In Part 2, Resources, the Project Manager shall employ the standard WBS template for the overall structure of the project.		
(2) In Part 2, Performance, the Project Manager shall describe the project's KPPs and establish the quantitative value for each to be achieved at each project milestone. This relationship can be in the form of a matrix that shows the KPP range (goal and threshold) and TRL to be achieved at each planned major demonstration or test.		

(3) In Part 2, Schedule, the Project Manager shall include a detailed schedule showing project milestones or planned major events. Managers are encouraged to identify alternative development paths in order to maximize the probability of success.		
(4) Only Project Managers of Category I and II ATD projects are required to complete Part 2, Acquisition Project Baseline.		
(5) Part 3, Technology Strategy shall be replaced with Part 3, Technology Insertion, and the Project Manager shall describe how the technology end item deliverable(s) (product or service) will transition to application or user adoption (i.e., a technology transfer strategy). In this section of the Project Plan, the Project Manager shall maintain close integration with the application community, and provide an exit strategy following technology transfer.		
(6) Part 3, Reviews shall include a description of planned Continuation Reviews for technology pull projects. The Continuation Reviews are decision points for the users to determine if the technology maturation is still viable to meet the users' requirements. The Continuation Reviews shall have users' concurrence on their schedule frequency, participants, and review criteria.		
5.3 Project Approval		
5.3.1 To secure approval for ATD projects, the Project Manager shall ensure that project deliverables are clearly defined and that proposed plans allow for quantitative measurements of performance that can be objectively assessed. ATD projects, like other projects, are subject to a NAR with an independent cost estimate (for Category I and II projects) prior to implementation. ATD Project Managers are expected to update the Project Baseline for the NAR; upon approval, the project's NAR Baseline is formally established. The requirements of Section 3.3 apply to ATD projects with the modifications in Section 5.2 above.		
5.4 Project Implementation		
5.4.2 Requirements: During implementation, the ATD Project Manager and the project team shall:		

5.4.2.a Monitor cost and schedule for breaches as required by paragraph 3.4.3.2e. A breach for ATD projects is measured against cost and schedule growth. The Project Manager shall provide notification to the Program Manager, the MDAA, and the GPMC when the growth in the projected (or actual) cost and schedule needed to deliver the threshold KPPs exceeds ten percent (10%).	
5.4.2.b Communicate progress to the Program Manager and user/application community.	
(1) The maturation progress of a technology at project milestones shall be measured using KPPs and TRLs.	
(2) The Project Manager shall ensure that internal technical reviews of progress are conducted at each project milestone to validate achieved values for each KPP. The Project Manager should secure concurrence from the internal review team that the project has met the quantitative values for each KPP at the milestone prior to reporting progress to the Program Manager. The Program Manager reports maturation progress for each ATD project to the GPMC.	
5.4.2.c The Project Manager shall ensure that changes to threshold KPPs established in the NAR Baseline are captured as part of updates to the Project Baseline.	
6 CHAPTER 6. Flight Systems and Ground Support Projects	
6.1 Four-Part Project Management Process	
6.1.h Flight systems and ground support projects shall meet the requirements of the four-part management process described in Chapter 3 and the requirements in this chapter. For projects for which the concept of operations requires activities such as extensive refurbishment of a flight system, extensive re-supply or maintenance (ground and on-orbit), additional requirements are imposed to cover additional planning, analysis and other activities necessary for a successful Phase E. These will generally be preceded with the phrase "For projects with long-term operations and sustainment" in italics. These additional requirements are not intended for projects with extended cruise time.	
6.2 Project Formulation	
6.2.1 Project Planning Requirements: The Project Manager and the project team shall:	

6.2.1.a Structure the detailed product-based project WBS and WBS dictionary based on the standard WBS in Appendix J, or shall obtain approval for WBS tailoring from the OCFO and OCE.		
6.2.1.b Generate a Contract WBS that supports cost/schedule control requirements for each contract following contractor selection or authority to proceed to implementation (see paragraph 3.4.3.2 for detailed EVM requirements).		
6.2.1.c Generate and maintain an Integrated Master Schedule (IMS) in the form of a detailed, logic-driven, highly-integrated network schedule using an automated project management (automated time phasing of tasks, critical path determination, schedule assessment, trend analysis, sort, select, and summarization capabilities, etc.) tool.		
(1) The project's progress against the IMS shall be assessed and updated monthly, or more often as required, to meet the program/project needs for assessment, control and communication.		
(2) The IMS baseline shall be managed through an established schedule change control process.		
(3) Schedule reporting during the project shall be done in accordance with the authorizing documents (e.g., Project Plan, Data Requirements Description (DRD), Schedule Management Plan (SMP)).		
(4) For projects with long-term operations and sustainment, identify the Initial Operational Capability (IOC) and Full Operational Capability (FOC) dates in the Integrated Master Schedule.		
6.2.1.d Obtain the additional approval of the cognizant MDAA for the Project Plan, at the discretion of the Mission Directorate.		
6.2.1.e Develop a Software Management Plan in accordance with NPR 7150.2, NASA Software Engineering Requirements.		
6.2.1.f Form an operations team organization compatible with the operations portion of the WBS and the project's flight and ground operations concept. This team shall include expertise in the following areas: flight operations, ground operations, safety, mission assurance, logistics, sustaining engineering, and any other expertise required for a successful Phase E, and/or Phase F.		
(1) For projects with long-term operations and sustainment, the Communications Plan shall discuss safety and problem reporting during long-term operations.		

(2) For projects with long-term operations and sustainment, the operations team shall conduct operational planning and analyses to support the flight systems and ground support project and to prepare for the transition of flight assets to long-term operations.	
6.2.1.g Assure that the project team seeks to learn and apply relevant lessons from successful flight systems and ground support projects, mission anomalies and mishaps.	
6.2.1.h Maintain the project team awareness of emergency response plans and procedures. The Project Manager and project team shall develop, maintain and test their project-specific plans (e.g., ground and mission emergency/contingency/failure plans) to ensure the team is adequately trained and prepared.	
6.2.2 Cost Estimation Requirements: The following requirements apply to both AO-driven and non-AO-driven flight systems and ground support projects, with exceptions for AO-driven projects noted:	
6.2.2.a For Category I and II projects, the Project Manager shall complete a preliminary CADRe (Parts A and B), in accordance with Table H-4 in Appendix H. Appendix E contains the initial CADRe DRD, but the latest CADRe DRD, available in the on-line NASA Cost Estimation Handbook (), should be used. For AO-driven projects, the requirement for a preliminary end-of-Phase A CADRe is waived in lieu of the submission of a copy of the winning proposal and concept study report.	
6.2.2.b For Category I and II projects, the Project Manager shall develop a risk-based LCCE (including a project cost S-curve) consistent with the preliminary CADRe for presentation at the preliminary NAR. This LCCE is called the project estimate and is appended to the CADRe as Part C.	
6.2.2.c For Category I and II projects, the Project Manager shall develop a Baseline CADRe and a risk-based LCCE (including a project cost S-curve) consistent with the Baseline CADRe for presentation at the NAR. This LCCE is called the NAR estimate and is appended to the CADRe as Part C. AO-driven Category I and II projects shall develop a risk-based LCCE (including a project cost S-curve) consistent with the Baseline CADRe for presentation at their Confirmation Review. This LCCE is called the CR estimate and is appended to the CADRe as Part C.	

6.2.2.d Category I and II projects shall provide updated CADRe submissions (all parts) at:	
(1) Critical Design Review (CDR),	
(2) Approximately six months after launch (to capture the project's technical definition and its Phase A through D costs), and	
(3) At the end of the planned project lifecycle (to capture final Phase E through F costs).	
6.2.2.e For projects with long-term operations and sustainment, the Project Manager shall work with the OCFO to establish a nominal project end date for the purpose of estimating operations and sustainment costs.	
6.2.3 Systems Engineering Requirements: The Project Manager and the project team shall:	
6.2.3.a Working with the Mission Directorate, Program Manager, customers and stakeholders, define a validated set of project requirements that are levied by the program and that include mission success criteria. These high-level project requirements shall be placed under configuration control in Phase A.	
6.2.3.b Develop operations scenarios and concepts, mission profiles, and mission operational modes for the purpose of fostering a better understanding of operational requirements, including LCC drivers for logistics and maintenance. The concept of operations describes the "who, what, when, where, and how" of the system.	
6.2.3.c Define the internal and external operational environments for the flight system.	
6.2.3.d For projects with long-term operations and sustainment, the concept of operations shall include the operational KPPs; the sustaining engineering, mission operations, ground operations, and integrated logistics support (e.g., maintenance concepts(s), sparing philosophy) concepts necessary for a successful Phase E.	
6.2.3.e For projects with long-term operations and sustainment, complete planned cost-performance trades, Analysis of Alternatives (AoA) studies, Cost As an Independent Variable (CAIV) assessments, and other systems analyses that include these operational KPPs as measures of effectiveness/measures of performance.	

(1) As a result of these studies and analyses, but prior to the end of formulation, the Project Manager shall specify quantitative values for each operational KPP, which will then be incorporated into the Project Baseline (along with the related project success criteria, schedule, and LCCE) and which will be used to evaluate project performance.		
(2) As a result of these studies and analyses, the Project Manager shall also establish a close link between each operational KPP and project operational performance requirements.		
6.2.3.f Define a validated set of flight and ground system requirements, including interface requirements and specialty engineering (e.g., safety, reliability) requirements.		
6.2.3.g Define a validated set of enabling system requirements, especially for integrated logistics support. (See NPD 7500.1, Program and Project Logistics Policy.)		
6.2.3.h Ensure that the requirements flow hierarchy is consistent with the Work Breakdown Structure.		
6.2.3.i Establish and maintain a (configuration-managed) requirements baseline in an established database.		
6.2.3.j Evaluate major changes to the requirements baseline through the systems analysis process as needed prior to any approval of such changes.		
6.2.3.k Ensure that trade studies are documented as part of the project library.		
6.2.3.l Ensure that models and simulations used to support these trade studies have been validated. Early in formulation, the project team should identify, develop, or otherwise acquire and implement the models (including prototypes and simulations) needed to accomplish all trade studies.		
6.2.3.m Identify and plan a series of trade studies to determine the most cost-effective means of meeting requirements for communications, tracking, data processing, and mission operations, including commercial options.		

6.2.3.n For Category I flight systems and ground support projects, complete an initial Probabilistic Risk Assessment (PRA) during formulation. NPR 8000.4, Risk Management Procedural Requirements, provides general criteria for selecting the scope of the PRA, while NPR 8705.5, Probabilistic Risk Assessment Procedures for NASA Programs and Projects, provides detailed procedures for performing a PRA.		
6.2.3.o Develop a technical resource margin management approach, and implement a tracking and reporting process to support it.		
6.2.4 Project Assessment and Control Requirements: The Project Manager and the project team shall:		
6.2.4.a Monitor changes in the project estimate presented at the preliminary NAR, and immediately inform the Program Manager if it increases by more than 25% in Phase B. The Project Manager should make every effort to produce a project cost estimate that contains an adequate cost-risk margin. During Phase B, life cycle cost growth beyond 25% of the preliminary NAR project estimate may result in a Termination Review initiated by the Program Manager or MDAA.		
6.2.4.b Provide the MDAA a Project Status Report (PSR) in formats ready for reporting to the OCFO when required to do so, as defined in GAO Report B-237602, "Project Status Reports." The OCFO will validate the PSR and forward it, through the Office of Legislative Affairs, to the appropriate congressional committees.		
6.3 Project Approval		
6.3.1 Purpose: The project approval process for flight systems and ground support projects is an on-going effort by senior NASA management to determine the project's readiness (at key milestones) to proceed to the next project phase or to implementation. To secure approval for a flight systems and ground support project, the Project Manager shall prepare (or revise) key project management documents (Project Plan, etc.) and present them to the GPMC at a decision review meeting.		
6.3.4 Requirements: In support of GPMC decision review meetings during project approval:		
6.3.4.a The Project Manager shall support evaluation by the IA organization in accordance with the project evaluation process. (See Section 6.5.)		

6.3.4.b The Project Manager shall prepare a project overview briefing for presentation at the GPMC milestone decision review meeting to include a summary of the project, the status of project documentation and products, and significant risks, all appropriate to the level of project maturity.		
6.3.4.c The Project Manager shall ensure that the project documents and products described in Table 6-2 are available at the GPMC decision review.		
6.3.4.d At that meeting, the IA results and findings, including the results of an ICE or ICA, will also be presented. The Project Manager shall then follow with a presentation of responses to the IA findings.		
6.4 Project Implementation		
6.4.a Project implementation entails continued execution of the Project Plan and all activities leading up to the successful delivery of the product or service that meets the original requirements. Successful project implementation relies on close interaction between the project team and the user and/or customer of the product or service. The Project Manager shall comply with the requirements in Section 3.4, and shall meet additional requirements in the following activities:		
a. Project assessment and control		
b. Systems engineering		
c. Design, develop, transition-to-use, and operations		
d. Capture knowledge.		
6.4.1 Project Assessment and Control Requirements: The Project Manager and the project team shall:		
6.4.1.a Determine and implement appropriate means for observing the project in all phases where technical risks have been identified, along with a means for collecting, trending, archiving, and analyzing data for post-anomaly investigation.		
6.4.1.b Implement a system to access "as-built" configurations, including photographic records and engineering drawings of all critical subsystem modifications, to assist in real-time troubleshooting.		
6.4.2 Systems Engineering Requirements: The Project Manager and the project team shall:		
6.4.2.a For Category I projects, ensure that the PRA is updated throughout implementation. The Project Manager should integrate PRA results into system design and operational risk mitigation trades.		
6.4.2.b Track and report project technical resource margins periodically throughout implementation.		

6.4.2.c Conduct Physical and Functional Configuration Audits.	
6.4.2.d For projects with long-term operations and sustainment, evaluate (using the systems analysis process) upgrades or modifications to deployed project systems, alternative product improvement investments, and decommissioning/disposal alternatives, as needed.	
6.4.3 Design, Develop, Transition-to-Use, and Operations Requirements: The Project Manager and the project team shall:	
6.4.3.a Deliver, deploy, and transition-to-use project flight and ground systems.	
6.4.3.b Deliver new technology through data, information, products, and services.	
6.4.3.c Execute acceptance/turnover agreements and data for those products requiring transfer of custodial responsibility.	
6.4.3.d Establish and maintain an integrated logistics support capability, including spares, ground support equipment, system maintenance and operating procedures, in order to sustain deployed hardware and software systems, consistent with mission requirements and plans.	
6.4.3.e Establish and maintain other enabling systems, as needed, so as to ensure that critical facilities, equipment, materials, training, simulation support, and other services are available when needed.	
6.4.3.f Provide sustaining engineering to promote efficiency enhancements, safety enhancements, and accommodate obsolescence.	
6.4.3.g Refine and implement plans for disposition/decommissioning of project assets (flight and ground) after the end of their useful life.	

6.4.3.h For projects with long-term operations and sustainment, the project during Phase E refines its operations success criteria, operations concept and plans to meet mission objectives specified in the Program and Project Plans, but the focus is on the tactical execution of the next mission increment, launch, or mission epoch. As the project produces its intended products and services, it continually explores new operations and sustainment options to meet the overall objectives, reduce operations costs and operational risks; fine tunes the internal management control functions that will be used throughout the remaining life of the project; assesses new technologies, modifications, and upgrades that potentially increase safety and performance, and lower operations costs; and tracks operational margins and reserves consistent with project safety requirements. If necessary, agreements (Program and Project Plans) are modified, and approved in accordance with the approval process. In order to accomplish this, the Project Manager and the project team shall:		
(1) Refine program/project goals, objectives, and success criteria as a part of the ongoing validation of the deployed project systems, and ensure that these flow down as appropriate to lower-level operations plans.		
(2) As applicable, refine and incorporate updated mission plans and technology upgrade strategies, infrastructure plans, acquisition strategies, technical and management implementation plans, space operations service agreements, launch services agreements, and other internal agreements into the Project Plan.		
(3) Continually examine opportunities to exploit promising product improvement technologies that could reduce program/project operational risk, reduce LCC, gain performance, correct newly uncovered design defects, or overcome operational constraints. The Project Manager should make recommendations regarding which product improvement technologies should be funded by the project, and which should be considered for funding at higher levels.		
(4) Continue to work with the Office of External Relations and the MDAA to identify potential non-NASA partners and necessary agreements for international or interagency; all activities and documentation must be consistent with policy and with program or Agency-level agreements with partners.		

(5) Ensure that the deployed project systems continue to function as intended, perform trend analyses as needed of:	
(i) System incidents, waivers/deviations, problem reports, and anomalies	
(ii) Key performance parameters (KPPs) for operations and sustainment	
(iii) Project technical resource margins.	
6.4.4 Capture Knowledge Requirements: The Project Manager and the project team shall:	
6.4.4.a Capture and forward summaries of project costs as a function of the WBS, and other performance information, to the OCFO Cost Analysis Division for inclusion in the ONCE database using the CADRe format.	
6.4.4.b Archive all relevant project records and data (drawings, analyses, reports, etc.) in the project library in electronic format.	
6.5 Project Evaluation	
6.5.3 Requirements: To accomplish the project evaluation process, the Project Manager shall:	
6.5.3.a Prepare project briefings and material demonstrating the project's readiness to continue, and present them at the IA organization site field review. The Project Manager should consult Table H-1 in Appendix H for other assessment criteria.	
6.5.3.b Following the NAR approval, provide the IA organization access to project information databases, performance data, meetings, and NASA and contractor sites in accordance with the ToR. This includes access to project cost-performance evaluations, including EVM data for Category I and II projects.	
7 CHAPTER 7. Institutional Projects	
7.2 Project Formulation	
7.2.2 Requirements: This document recognizes that different development models and historical practices apply. IT and OFI projects often take the form of spiral or incremental developments with a sustained level-of-effort throughout development. CoF and ECR projects, on the other hand, are usually waterfall developments following tried-and-tested construction practices. Therefore, separate requirements are identified below.	

7.2.2.1 For CoF projects, the FPM shall comply with the requirements of NPR 8820.2, Facility Project Implementation Guide, rather than Section 3.2 of this document. For ECR projects, the EPM shall comply with the requirements of NPR 8590.1, Environmental Compliance and Restoration Program Implementation, rather than Section 3.2 of this document.		
7.2.2.2 For IT and OFI projects, the Project Manager and the project team shall:		
7.2.2.2.a Comply with the requirements of Section 3.2.		
7.2.2.2.b Prepare a Project Plan containing the elements described in Appendix D with the following modifications:		
(1) In Part 2, Resources, the Project Manager shall employ the appropriate WBS template for the overall structure of the project.		
(2) Project IT investments shall be separately planned for, evaluated in terms of Return on Investment (ROI), budgeted, and managed.		
(i) Planning shall cover the life cycle of the project and be sufficient to provide for data recovery, contingency facilities, and reconstitution of critical IT resources.		
(ii) The IT Project Manager shall conduct risk assessments in accordance with NIST Special Publication 800-30, Risk Management Guide for Information Technology Systems, and prepare an IT Security Plan in accordance with NIST Special Publication 800-18, Guide for Developing Security Plans for Information Technology Systems.		
7.2.2.2.c The Project Manager shall comply with the requirements of NPR 7150.2, NASA Software Engineering Requirements, for software elements.		
7.2.2.3 Because of the nature of institutional projects, the duration of the project may be substantially shorter than the life of the asset created. The Project Plan shall address the transition of responsibility for the asset to the receiving operations and sustainment organization.		
7.3 Project Approval		

7.3.3 For all other institutional projects, the Project Manager shall meet the requirements of paragraph 3.3.3. Institutional projects, like other projects, are subject to a NAR prior to implementation and an ICE, if warranted by project category. As a part of securing approval, all projects with IT elements shall be assessed against compliance with the current approved version of the NASA Enterprise Architecture (EA). This means that the CIO must have access to mission Program and Project Plans when they contain IT elements. Approval of such plans is provided by the OCIO through participation in the IC and GPMC structures.	
7.4 Project Implementation	
7.4.2 During CoF project implementation, the FPM shall comply with the requirements of NPR 8820.2, Facility Project Implementation Guide, rather than Section 3.4 of this document. During ECR project implementation, the EPM shall comply with the requirements of NPR 8590.1, Environmental Compliance and Restoration Program Implementation, rather than Section 3.4 of this document.	
7.4.3 During IT and OFI project implementation, the Project Manager shall:	
7.4.3.a Comply with the requirements of Section 3.4.	
7.4.3.b Monitor changes to security plans and procedures to ensure that the project's security controls and implementation activities are well-matched to threat assessments related to physical and information security.	
7.4.3.c Prepare user operational training and familiarization documentation to ensure a smooth transition-to-use, customer acceptance, and high utilization of the product or service under development.	
7.4.3.d For IT investments, utilize NASA software assurance personnel and the requirements found in NASA-STD-8739.8, Software Assurance Standard, and when indicated or selected, use the NASA IV&V capabilities.	
7.4.3.e Provide the MSOD a Project Status Report (PSR) in formats ready for reporting to the OCFO when required to do so, as defined in GAO Report B-237602, "Project Status Reports." The OCFO will validate the PSR and forward it, through the Office of Legislative Affairs, to the appropriate congressional committees.	

7.5 Project Evaluation	
7.5.1 Agency visibility into the progress of institutional projects will occur through independent project reviews, program reviews by the governing authority, and biennial (every two years) PIRs conducted by the IPAO. CoF projects are evaluated using the criteria outlined in NPR 8820.2, Facility Project Implementation Guide, and ECR projects in accordance with NPR 8590.1, Environmental Compliance and Restoration Program Implementation. To support evaluation, all other institutional Project Managers shall comply with the requirements of Section 3.5.3.	
7.5.2 IT projects shall be assessed throughout their lifecycle to evaluate their effectiveness in supporting program/project objectives. Assessments shall be made against appropriate metrics and benchmarks to evaluate the cost and performance of IT investments.	
8 APPENDIX J: Flight Systems and Ground Support Project Work Breakdown Structure (WBS)	
J.3.2 Requirements: For flight systems and ground support projects:	
a. The standard flight systems and ground support project WBS shall be applied to new projects established from June 1, 2005 forward. It is not intended to be applied retroactively to existing projects.	
b. The standard flight systems and ground support project WBS shall apply to the entire life cycle of the project, including disposal and decommissioning.	
c. The standard flight systems and ground support project WBS shall apply to both crewed and robotic projects.	
d. Flight systems and ground support projects shall use the standard Level 1/2 WBS elements (See Section J.5.). Specifically:	
(1) The Project Name shall be WBS Level 1.	
(2) The title of each WBS Level 2 element can be modified to facilitate project-unique titles, but the content of each must remain the same. If the linkage of the standard and the project-unique title are not intuitive, the project-unique title shall be cross-referenced to the standard title and provided to the WBS Review Team.	

(3) The set of standard WBS Level 2 elements do not comprise an exhaustive or exclusive set of WBS elements. Additional WBS elements may be added horizontally (i.e., at Level 2) as long as the content of which does not fit into the content of any existing standard WBS elements.	
(4) For each standard WBS Level 2 element, the subordinate (children) WBS elements at Level 3 and lower shall be determined by the project.	
(5) The Level 3 and lower elements can differ from project to project, but shall include only work that rolls up to the standard WBS Dictionary definition of the Level 2 element. (See Section J.6.)	
(6) If there is no work to fit into a standard WBS element, then an inactive placeholder element (and an inactive placeholder financial code) shall be established.	
(7) The financial WBS shall align with the technical WBS.	
(8) The management assigned to each WBS element may differ from project to project.	
e. Changes to the standard flight systems and ground support project WBS shall be governed by the WBS Review Team.	
f. Other changes can be made to the standard flight systems and ground support project WBS, but must be approved by WBS Review Team. Requested changes shall be made on a waiver form via the Meta Data Manager (to be in operation June 1, 2005) and submitted to the WBS Review Team, whereby a stringent review process occurs ensuring valid rationale is used to support the changes.	

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